

## APPENDIX A

### TFX CONTRACT INVESTIGATION

Hearings before the Permanent Subcommittee on Investigations of the  
Committee on Government Operations, United States Senate

Pages 2339 - 2340

MR. ADLERMAN. Dr. Charyk, you say you looked at the Boeing proposal. What did you ask in the Boeing proposal?

DR. CHARYK. I looked at sections that dealt with the materials of primary interest to me; namely, the question of titanium.

MR. ADLERMAN. Did you look at the drawings?

DR. CHARYK. I saw, as I recall, a sketch which showed the structural design of the wing.

MR. ADLERMAN. At what thicknesses were they using titanium?

DR. CHARYK. My recollection is that they were somewhere around three-quarters of an inch or an inch.

MR. ADLERMAN. Are you familiar which way they were using the titanium?

DR. CHARYK. They were used in the main wing carriage structure.

MR. ADLERMAN. What did you criticize in that, that the thickness was too thick?

DR. CHARYK. That Boeing had no experience upon which to base the use of titanium in thicknesses that large in highly stressed members. One would anticipate that if one were proposing the use of a material in the way that it had never been used before, that one would go into considerable analysis to justify the use of that material.

In other words, the structural characteristics of the material are completely different. Boeing had switched from the use of steel to the use of titanium. The structural characteristics of the material are quite different. The wings will deflect in a different manner. Furthermore, when the aircraft or the wings are exposed to dynamic forces you are going to have flutter problems, you are going to have all kinds of structural dynamic problems, you are going to have fatigue problems.

These can be very critical. As we have seen in the B-52 the use of a material which was a very common material resulted in cracks which were very serious. They resulted in the loss of life, the loss of one or more of our B-52's, a major remodification program costing the better part of a quarter of a billion dollars. This is using materials that we are reasonably familiar with.

MR. ADLERMAN. The B-52 had no part of titanium as far as we are concerned.

DR. CHARYK. I am simply saying here is a material with which we were familiar and we had not anticipated the kinds of problems that could occur. It led to the loss of life and it led to the cost of the Air Force and the taxpayers of something of the order of a quarter of a billion dollars. Here we are talking about a brandnew airplane. We are talking about a material being used in a fashion never used before. We are faced with the lack of supporting analysis. It seems to me that this was a very serious deficiency in the proposal.

THE CHAIRMAN. Doctor, you mean in this one particular piece that it had never been used before? It has been used in about everything else in an airplane, has it not?

DR. CHARYK. It had never been used in major structural members at this thickness at these stress levels.

THE CHAIRMAN. Are you sure of that?

DR. CHARYK. I am sure of that, Senator.

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4 December 1964

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